FOOD, FEEDING ECOLOGY AND CONDITION INDEX OF THE BRACHISH RIVER PRAWN *Macrobrachium macrobrachion* (HERKLOTS, 1851) (CRUSTACEA, DECAPODA, PALAEMONIDAE) IN THE CROSS RIVER ESTUARY, SOUTH-EASTERN NIGERIA

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Abstract
Investigations were carried out to study the food, feeding ecology and condition index of the brackish river prawn, *Macrobrachium macrobrachion* (HERKLOTS, 1851). One thousand, nine hundred and ninety-seven live specimens which comprised of individuals representing all size groups of the prawn were studied. The specimens were obtained from the commercial artisanal catches at Nsidung Beach along Calabar River (40301N and 80201E). Although algae formed the bulk of the diet of the prawn with 44.61% occurrence, other food items: detritus (24.30%), crustacean remains (23.14%), mud/sand particles (6.23%), fish bones and scales (2.14%) and small worms (0.21%), were also consumed. The sub-adult and adult prawns respectively exhibited similar condition index of 0.98, while the youngs showed a condition index of 0.82. The significance of the similarities in condition indices between the sub-adult prawns and the varied condition indices among the young, sub-adult and adult prawns in addition to the exhibition of an overlapping feeding ecology by the prawn is discussed.
KEYWORDS: Food, feeding ecology, condition index, *Macrobrachium macrobrachion*, Cross River Estuary.

Introduction

Nature offers a great diversity of organisms that are used as food by fish, and these differ in size and taxonomic group (Olojo *et al.* 2003). The dietary analysis of organisms in their natural habitat enhances the understanding of the growth, productivity, abundance and distribution of organisms (Bagenal, 1978, Fagade & Olaniyan, 1973, Odum & Heald, 1972 and Crisp *et al.* 1978).

The diet of cultured species does not provide precise and reliable information on the food, feeding ecology and condition index of such species (Thomas, 1966; Bowen & Windell, 1978 and Arringnon, et al. 1994). Hence, most studies which are aimed at obtaining such information as food, feeding ecology and condition index of organisms are based on the analysis of gut contents of organisms caught from their natural habitats (Longhurst 1957, Nair & Jacob, 1982, Odum, 1972 and Bagenal, 1978).

Materials and Methods

The Cross River Estuary is the largest estuary in the Gulf of Guinea (Moses, 1988), occupying a total of 54,000km 2 (Akpan and Offem, 1991). It has a high biodiversity, supporting a wide variety of shell and finfishes (Nawa, 1986), with *Macrobrachium macrobrachion* usually dominating the catch of the *Macrobrachium* fishery. It has been reported to constitute 66.4% by weight and 80.6% by number in the catches of the commercial artisanal fishery of the *Macrobrachium* fishery of the Cross River Estuary, Nigeria (Enin, 1998).

The specimens of *M. Macrobrachion* used in this study were obtained from the commercial artisanal catches at Nsidung Beach, Calabar (Fig.1), a major landing station of shrimp fishery on the left bank of the Calabar River. The prawns were caught mainly with beach sein, and basket traps and hand-pushed trap nets as by-catches (Udolisa, Solarin, Lebo & Ambrose, 1994 and Enin, 1998). Sampling was done between February and June, 2004, on weekly basis.

One thousand nine hundred and ninety-seven live specimens, comprising of all size groups were used for the study. These were immediately killed by injection with 4% formaldehyde solution through the mouth and anus regions with syringe and needle (Costa & Wanninayake, 1986). This reduced to the minimum, any post-humous digestion of the specimens, which were later transported to the Marine Biology Laboratory of the Institute of Oceanography, University of Calabar, Calabar-Nigeria, for analysis.

The total length (TLcm) (distance between tip of rostrum and tip of telson) (Powell, 1979) and weight (g) of the 1997 specimens were measured to the nearest 0.1cm and 0.1g, respectively. The specimens were divided into 3 arbitrary size classes (Job & Udo (2002), of Juvenile (1.9-5.9cm), sub-adults (6.0-7.9cm) and adults (8.0 18.9cm). These arbitrary classifications were similarly used in the selection of the prawns during the analysis of the gut contents of the species for the purpose of determining its food, feeding ecology and condition index. The guts were carefully excised, and preserved in 4% formaldehyde solution for 3 days prior to analysis according to the method used by Marioghae (1982) and Costa & Wanninayake (1986). Various diet components were identified and enumerated with a Carl Zeiss JÜRGENS phase contrast microscope model 475002-02 (mg x 10). The respective guts were matched with the prawn being examined based on the methods employed by Johnson (1968), Miller (1971), Marioghae (1982), Costa & Wanninayake (1986) and Job & Nyong (2004).

Frequency of occurrences (%) was made for all categories of diet components and categorized as particulate matter, microflora/fauna and macroflora/fauna, respectively. Identification of diet components was carried out by the use of identification guides to the nearest possible taxa (George, 1972; Marioghae, 1982 and Job & Udo (2002) and Job & Nyong (2004).

Results

Examination of the gut contents of *M. macrobrachion* reveals the presence of six different diet components. These include algae (44.61%), detritus (24.03%), Crustacean remains (23.21%), mud/sand particles (6.23%), fish scales and bones (2.41%) and small worm remains (0.21%). A total of 87 specimens (4.55%) of the prawns examined had empty guts. The frequency of occurrence (%) of each of the identified food items is shown in table 1, while table 2 shows the distribution by number of the six different diet component of *M. macrobrachion* studied. Figures 2 and 3 respectively show the distribution by number of the different diet components of the prawn under study.

Discussion

The analysis of the gut content of *M. macrobrachion* reveals that though the prawn feeds on a wide variety of food items, it shows preference for algae. There is an exhibition of an overlapping feeding ecology as the guts of the prawn contains various percentages of invertebrates, detritus, fish scale and bones, mud and sand particles. This, according to Ologo, *et al.* (2003), is an important strategy by an organism to avoid inter- and intra-specific competition for available food. This explains the availability of *M. macrobrachion* all-year round in the Cross River Estuary.

The presence of mud/sand particles in the gut of the prawn is considered as incidental and is associated with the bottom substratum, which some algal species are attached (Mann, 2000; Goldman & Horne, 1983 and Prasad, 2000).

The absence of fish scales and bones in the guts of juvenile *M. macrobrachion* is related to the size and nature of the food items. Juvenile organisms, according to Bagenal & Tesch (1978), Lagler *et al.* (1977), and Ricker (1971), are not capable of injesting large-sized and hard food items as a result of the tender nature of their digestive system. Job and Nyong (2004) observed that the guts of juvenile *Macrobrachium vollenhovenii* did not contain fish scales and bones during their investigations on the diet composition of the prawn obtained from the same area.

The condition indices calculated for the different size groups were observed to vary among the different length classes. There was however a similarity in condition index between the sub-adult and the adult prawns studied. They stood at 0.82 for the 1.9-5.9cm total length, 0.98 for the 6.0-7.9cm and 8.0-18.9cm total lengths respectively. The implication of this is significant to the fisheries of *M. macrobrachion* in the Cross River Estuary. The juveniles feed vigorously to grow while the young adults feed to develop sex organs for reproduction, and the adults feed for sustenance (Ricker, 1971; Lagler *et al.* 1977 and Mann, 2000).

The exhibitions of varied condition indices among the different size groups and similar condition index between the sub-adult and the adult prawns, in addition to overlapping feeding ecology by the prawn, enhance the sustainability of the fishery of the prawn in the Cross River Estuary.

Conclusions

This study presents for the first time, the food, feeding ecology and condition index of *M. Macrobrachiom* of the Cross River Estuary, and acts as a base line for further studies especially on the algal species, which constitute the bulk of the diet of the prawn.

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Table 1. Frequency of occurrence (%) of the various diet components and condition indices within and among the different length classes of *Macrobrachium macrobrachion* of the Cross River Estuary, South Eastern Nigeria.

S/N	Length TL (cm) classes	No of guts analyzed	No of empty guts	Algae	Detritus	Crustacean remains	Mud/sand particles	Fish bones and scales	Small worms remains	Condition indices
1	1.9-5.9	257	12	151	101	113	15	0	0	0.82
2	6.0-7.9	697	17	207	163	171	41	15	0	0.98
3	8.0-18.9	1043	58	494	195	158	63	31	14	0.98
		% occurrence		44.61	24.03	23.14	6.23	2.14	0.21	

Table 2. Distribution (by number) of the different diet components in the gut of *M. macrobrachion* of the Cross River Estuary, South Eastern Nigeria.

Length TL (cm) classes	Algae	Detritus	Crustacean remains	Mud/sand particles	Fish bones and scales	Small worm remains
1.9-5.9	151	101	113	15	0	0
6.0-7.9	209	163	171	41	15	0
8.0-18.9	494	195	158	63	41	4
Total number of individual diet component.	852	459	442	119	31	4

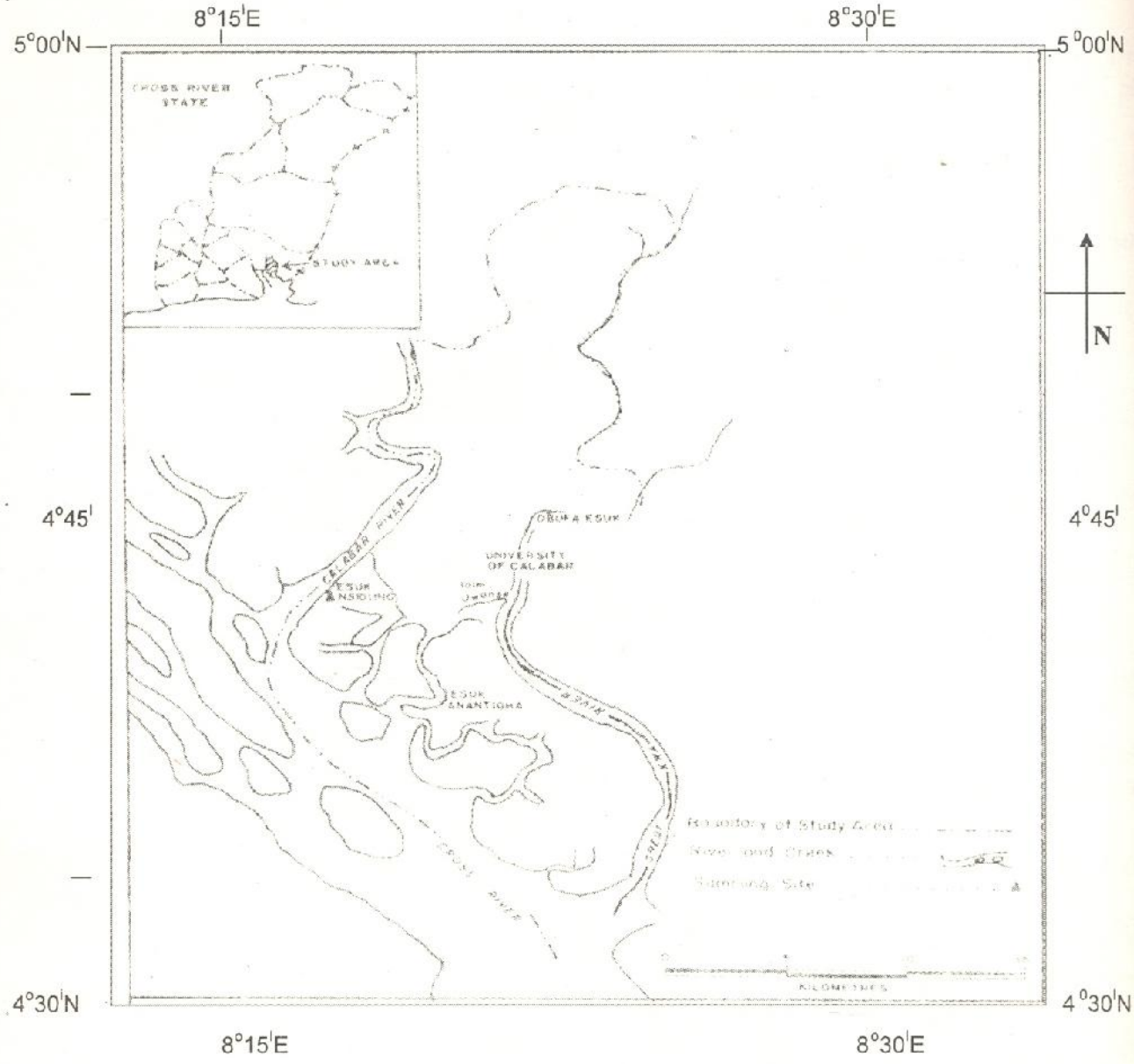

Fig.1: The Cross River Estuary showing study site.

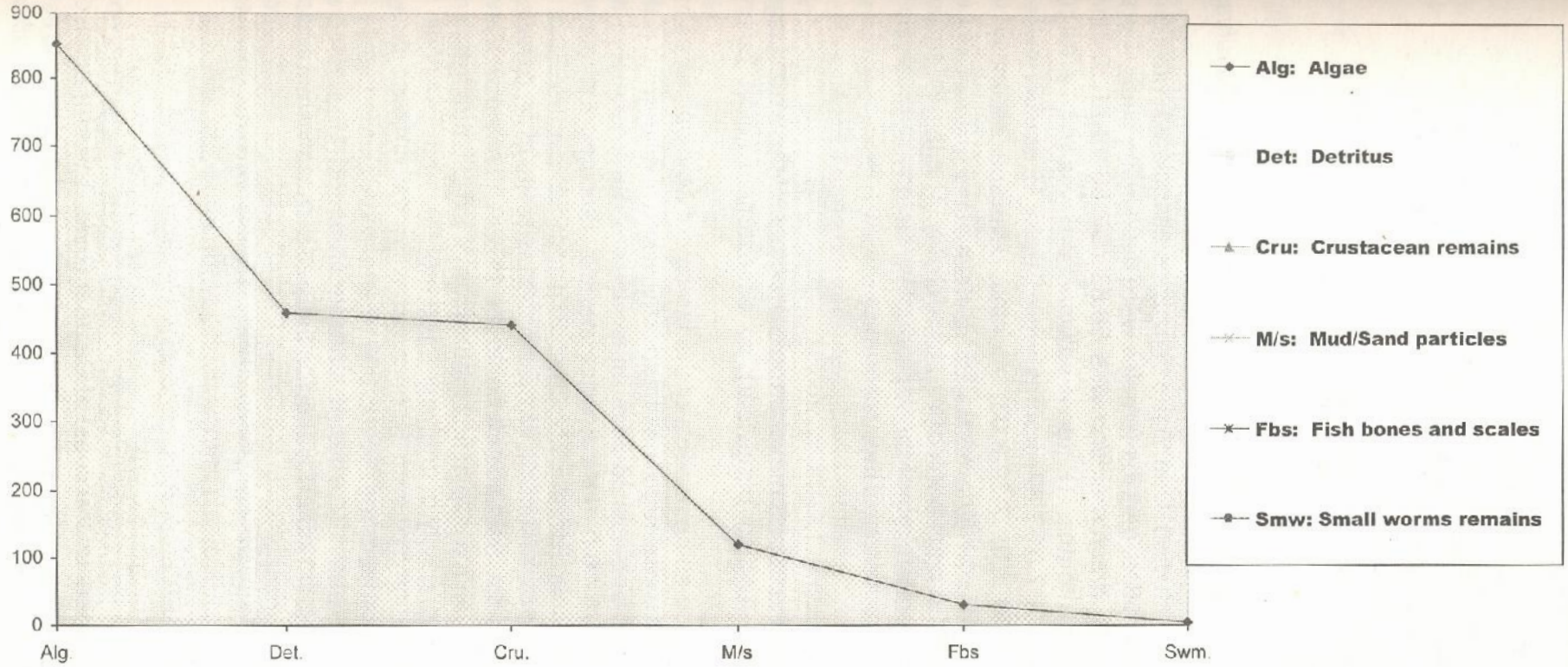

Fig.2: Distribution (by number) of diet components in the gut of *M. macrobrachion* of the Cross River Estuary, South Eastern Nigeria.